

SURVEY AND REPORT  
OF  
PRESENT AND FUTURE LOAD REQUIREMENTS  
OF  
RURAL ELECTRIC COOPERATIVES

GLACIER COUNTY ELECTRIC COOPERATIVE, INC.,  
(Mont. 30 Glacier)  
CUT BANK, MONTANA

MARIAS RIVER ELECTRIC COOPERATIVE, INC.,  
(Mont. 31 Toole)  
SHELBY, MONTANA

APPLICATIONS AND LOANS DIVISION  
RURAL ELECTRIFICATION ADMINISTRATION  
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\* SURVEY AND REPORT  
OF  
PRESENT AND FUTURE LOAD REQUIREMENTS  
OF  
RURAL ELECTRIC COOPERATIVES 1/

Glacier County Electric Cooperative, Inc., *and*  
(Mont. 30 Glacier)

Marias River Electric Cooperative, Inc. *x*  
(Mont. 31 Toole)

PURPOSE OF REPORT

The purpose of this survey and report is to investigate and tabulate, insofar as possible at this time, the existing electrical loads now served by the subject cooperatives, together with prospective electrical loads which may reasonably be expected to develop and be served by these two cooperatives during the next two, five and ten years.

The immediate purpose of the report is to determine the need for the proposed construction by the Marias River Electric Cooperative, Inc., of a 55 KV transmission line from Conrad in Pondera County to Shelby for the purpose of supplementing power now being generated by the cooperative's plant at Shelby. The proposed 55 KV transmission line will be energized by the Montana Power Company at Conrad.

Results of this study are also expected to furnish present and probable future power requirements of the cooperatives for consideration by the Bureau of Reclamation in its studies of the feasibility of extending transmission lines into the area to provide adequate low cost power to these cooperatives as well as to other loads independent of this study. In this connection, it is understood that projected plans of the Bureau of Reclamation contemplate construction of a 154 KV transmission line

1/ Prepared by Chas. A. Jackson, Jr., Field Representative, Rural Electrification Administration, USDA.



from Havre, Hill County, to Shelby, in which event the proposed 55 KV transmission line to be constructed by the Marias River Electric Cooperative at this time would be operated to supply part of the power requirements of a third cooperative, the Sun River Electric Cooperative, Inc., (Montana 2 Cascade) at Conrad, presently served by the Montana Power Company. It is probable that the Bureau of Reclamation will supply the power requirements of the three cooperatives at some future time when such transmission line from Havre to Shelby has been put into operation.

This report does not purport to establish the feasibility of the cooperatives serving all future loads tabulated in the survey nor does it intend to imply that funds are or will be earmarked by the Rural Electrification Administration for service to such loads. Each application for REA loan funds will, as in the past, be considered on its own merits.

Other purposes of the report are (1) to provide a foundation for a long range rate study, (2) to furnish pertinent information in connection with future system studies to be prepared by the cooperatives, and (3) to serve as a guide for a comprehensive power use program to be initiated by the cooperatives.

Consideration has been given to existing rural industries which are not now receiving central station power and to those which may be expected to be established as a result of further development of natural resources of the area.

The attached Drawing No. 1 shows:

- (1) Tentative cooperative boundaries;
- (2) The cooperatives' existing and proposed transmission lines;
- (3) Existing utility and publicly owned transmission lines; and,
- (4) The estimated total kilowatt demand and kilowatt hour consumption for each cooperative for the years 1946, 1948, 1951, and 1956.



## SUMMARY & CONCLUSIONS

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The survey reveals that a substantial potential market for electrical energy exists in the area served by the subject cooperatives.

Table No. 10 of the load estimates indicates that there will be a maximum demand on the two interconnected systems of approximately 2,900 kilowatts in 1946, 7,215 kilowatts in 1948, 11,400 kilowatts in 1951 and 17,000 kilowatts in 1956. It is likewise estimated there will be a total annual energy requirement on the two systems of 11,939,400 kilowatt hours in 1946, 32,661,000 kilowatt hours in 1948, 51,457,000 kilowatt hours in 1951 and 80,414,000 kilowatt hours in 1956. These estimates indicate that the load factor will be approximately 47% in 1946, 51.7% in 1948, 51.4% in 1951 and 53.5% in 1956.

The survey further reveals that the estimated demand on the Shelby generating plant will exceed the plant's installed capacity during the peak season of 1946 and that there is an urgent need for supplementing the power generated at the Shelby plant, either by the installation of additional capacity in the plant or by construction of the proposed 55 KV transmission line from Conrad to Shelby, a distance of approximately 26 miles. At the present time, it appears that during the next two years the capacity of the plant could not be materially increased because of the scarcity of suitable equipment. Construction of the proposed Conrad-Shelby transmission line is therefore necessary in order to provide this badly needed power. 1/

It is estimated that power transmitted over the proposed transmission line, plus energy generated at the Shelby plant, would provide

1/ On October 2, 1946, \$85,000 was allocated to the Marias River Electric Cooperative, Inc. for the construction of the Conrad-Shelby transmission line and substation. Administrative Order No. 1145, Rural Electrification Administration, U.S.D.A.



farm, non-farm and commercial consumers, oil well pumps, irrigation pumps, grain elevators, flour mills, fann stations, resort hotels, cabin camps and other miscellaneous loads.

In determining the estimates of average consumption per consumer, consideration was given to the experience of operating systems in areas of similar economic and productive characteristics; the application of electric power to productive use determined by the prevailing type of farming and other related enterprises existing in the area; effect of electric service toward stimulation of new enterprises, and other economic activities in the community; the general progressiveness of the farm people and their willingness to adopt new methods and techniques with the use of electricity in farming operations; and the influence of low wholesale power rates.

In large measure the load estimates included in the report represent a judgment arrived at through experience and an understanding of the factors affecting the future use of electricity in rural areas.



## METHOD OF SURVEY AND SOURCES OF INFORMATION

A detailed inspection of the area was made in the field. The operating records of the Marias River Electric Cooperative, Inc., and the Glacier County Electric Cooperative, Inc., were examined to secure information of the systems' operating experiences. Much valuable information concerning loads now being served by the cooperatives was secured from Mr. Robert McPhillips and Mr. Emil Rudman, project managers, who for the past twenty years have been employees of the Great Northern Utilities, recently acquired by the cooperatives.

Additional information was secured from County Agricultural Extension Agents, Agricultural Adjustment Agency officials, officials of Blackfeet Indian Reservation, Browning, Montana, Toole County Oil Recorder, representatives of the Montana State Oil Conservation Board, the Montana State Board of Equalization at Helena, Montana, and representatives of the Glacier National Park Service.

The estimated extent of future increase of consumption of electrical energy on the cooperatives' systems has been compiled in two parts, namely: (1) Increase in power requirements of the Existing Systems as of 1946, and (2) Increase in power requirements due to future additions to the existing systems.

The estimated increase in power requirements of the "Existing Systems as of 1946" include estimates for the year 1946 and for the periods 1947 to 1956, inclusive, and are based on the historical records of operation in this area by the Great Northern Utilities recently acquired by the cooperatives.

The estimated power requirements of "Future Additions to the Existing Systems" concerns loads which will be added by new construction to serve



farm, non-farm and commercial consumers, oil well pumps, irrigation pumps, grain elevators, flour mills, fann stations, resort hotels, cabin camps and other miscellaneous loads.

In determining the estimates of average consumption per consumer, consideration was given to the experience of operating systems in areas of similar economic and productive characteristics; the application of electric power to productive use determined by the prevailing type of farming and other related enterprises existing in the area; effect of electric service toward stimulation of new enterprises, and other economic activities in the community; the general progressiveness of the farm people and their willingness to adopt new methods and techniques with the use of electricity in farming operations; and the influence of low wholesale power rates.

In large measure the load estimates included in the report represent a judgment arrived at through experience and an understanding of the factors affecting the future use of electricity in rural areas.



## DESCRIPTION OF THE AREA

This area located in northwest Montana is comprised of all but the most western part of Glacier County, Toole County and the west half of Liberty County.

Glacier County, the most western county in the area, comprises approximately 3,000 square miles bordered by Canada on the north, the main range of the Rocky Mountains on the west, Pondera County on the south and Toole County on the east. The Blackfeet Indian Reservation, comprising approximately 85 percent of Glacier County with most of the land being owned by the Indians, offers an ideal pasture and grazing area for thousands of head of beef cattle and sheep. Most of this virgin area abounds in native grass and has never been turned by plow.

Toole County, to the east of Glacier County, with an area of approximately 1,900 square miles, and Liberty County with approximately 1,400 square miles, consists of treeless plains and the Sweetgrass Hills in the northwestern corner of Liberty County located east of Toole County; Sweetgrass Hills rising to an elevation of from 5,000 to 7,000 feet above sea level, form an isolated range with five buttes from one-half to five miles across and support large and excellent grain and cattle ranches.

The Kevin-Sunburst and Cut Bank oil fields, one of the largest oil and gas fields in the Rocky Mountain Region, first discovered in 1922, supply natural gas for industry and household use in all major cities in western Montana. Trainloads of gasoline are shipped daily from several large refineries in Toole and Glacier Counties.

The main line of the Great Northern Railroad from Chicago to the West Coast traverses the area from east to west, furnishing excellent



passenger and freight service. A branch line of this railroad from Great Falls, Montana, to Coutts, Canada, traverses Toole County, passing through the town of Shelby.

U. S. Highway No. 2 traverses the area paralleling the Great Northern Railroad, and U. S. Highway No. 91 going north through Toole County joins the Canadian Arterial Highway No. 4, soon to become a four-lane highway, at Coutts, Canada.

Cut Bank is on the main route of the Northwest Airlines from California to Edmonton, Canada. This airline will soon be extended to Alaska. The Great Northern Airlines plan soon to inaugurate air service from Spokane, Washington, to St. Paul, Minnesota, including stops on regular schedule at Cut Bank.

The towns of Shelby, Kevin, Sunburst, Cut Bank, Browning, and Glacier Park are served by the cooperatives. These towns were formerly served by the Great Northern Utilities, recently acquired by the cooperatives.

Precipitation of rain seldom exceeds fifteen inches per year. Long winters are broken by warm Chinook winds in January and February. However, freezes and snow occasionally occur as late as June and snows fall as early as September, but this area always averages five hours of sunshine to every four hours of sunshine in the Mississippi Valley.



## ECONOMY OF THE AREA

Oil and Gas. In 1922 the Kevin-Sunburst oil field north of Shelby was discovered. Since that date expansion has continued here as well as in the Cut Bank field both north and south of the town of Cut Bank. Development still continues in both fields and the odd combination of oil drillers and gas pumpers working in adjacent areas is found in these fields, which are considered among the most outstanding oil and gas fields in the West. From these fields natural gas, which is almost pure methane, is supplied the towns of Kevin, Sunburst, Santa Rita, Cut Bank, Shelby, Livingston, Big Timber, Butte, Anaconda, Deer Lodge, Bozeman, Helena, and Great Falls. Some of the crude oil is shipped out of the area for refinement while much of it is refined by the Texas Oil Co., Carter Oil Co., Union Oil Co., and Big West Oil Co., at their refineries located in the heart of these booming oil fields. Wells in the Kevin-Sunburst field are approximately 1500 feet deep while wells in the Cut Bank field are drilled to a depth of 2900 feet.

Data obtained from the Geologic Survey, Department of Interior, indicates that the future ultimate recovery of oil from the Cut Bank field will amount to approximately 51,051,629 barrels and to approximately 11,123,594 barrels for the Kevin-Sunburst field. These estimates of the future petroleum reserves were made as of January 1, 1946. It was the opinion of members of the geologic staff that these estimates were on the conservative side. They mentioned that there was the possibility that the total productive acreages might be enlarged through new discoveries of other oil reserves. Also, the lower Madison and Devonian horizons had not been tested.



The well status of these two fields as reported by the Geologic

Survey on June 30, 1946 is as follows:

Well Status as of June 30, 1946\*

Area	Drilling		Producing		Shut In		Abandoned	Plugged and Abandoned	Total
	Active	Suspended	Oil	Gas	Oil	Gas			
Cut Bank <u>1</u> /	0	0	32	0	0	1	0	5	38
Cut Bank <u>2</u> /	7	2	675	97	0	11	0	162	954
Cut Bank <u>3</u> /	7	1	309	0	0	0	1	45	<u>363</u>
Kevin-Sunburst <u>1</u> /	3	3	170	16	5	2	3	267	469
Kevin-Sunburst <u>2</u> /	14	8	1248	174	4	15	3	1184	<u>2650</u>
Kevin-Sunburst <u>3</u> /	-	-	-	-	-	-	-	-	-

\*Source: Geologic Survey

1/ Federal Land

2/ Private and State

3/ Indian Land

According to the Mineral Yearbook, production of crude petroleum started in 1922 in the Kevin-Sunburst Field. The highest production was made in 1926, amounting to 6,630,000 barrels. During the period 1936-1944, production has ranged from 1,290,000 to 1,992,000 barrels. The average for this period was 1,686,000 barrels. On the basis of this average yearly production and the estimated future ultimate reserves on January 1, 1946, by the Geologic Survey, there would be 6.6 productive years remaining in the Kevin-Sunburst field. However, experience in other fields indicates there is a tendency for production to taper off over a much longer period of time.

There has been a rapid increase in the production of crude petroleum



in the Cut Bank field according to the Mineral Yearbook. Oil was first discovered in this field in 1933 and reached its peak production in 1942. The average production during the five-year period 1940-1944 was 5,072,000 barrels. If this average production were to continue, it would take 10 years to produce the remaining ultimate reserves in this field as estimated by the Geologic Survey. As previously mentioned, it is to be expected that production would taper off over a longer period.

Agriculture. Large grain farms and large cattle and sheep ranches are typical of this broad flat to rolling expanse of country. Typical grain farms in Liberty, Toole, and Glacier Counties are approximately 1500 acres each. Half of the field is planted in grain each year while the other half remains in idle fallow to gather moisture, two seasons' rain producing but one crop of grain in this low moisture area. Wheat, mustard, barley and oats are the principal crops. This area is a part of the Montana Triangle said to be the greatest mustard producing area in the world.

Beef cattle and sheep are found in great numbers in this ideal grazing country with its native dry grass, many thousands of acres of virgin sod having never been turned by plow. Ranches of 6000 acres each and even larger are not uncommon.

It will be noted that the major portion of the grain is raised in Toole, Liberty and in the eastern part of Glacier Counties, the balance of the area being occupied by the Blackfeet Indians who prefer to graze their land. To a certain extent irrigation is practised in Toole County along the Marias River, gasoline engines being used to raise the water to higher levels from where it flows by gravity through the fields. For twenty years organized effort has been exerted toward an irrigation



district to be located northeast of Shelby comprising approximately 100 homesteads. On the Indian Reservation in Glacier County four gravity irrigation districts are located embracing approximately 100 homesteads, producing for the most part hay. One-half of the homesteads are farmed by whites and the balance by Indians.

According to the 1945 census, nearly 90 percent of the land area of Toole County was in farms and ranches. Farm and ranching units averaged 2,518 acres in 1945 compared with 1,833 acres in 1940. Twenty-four percent of the acreage in farms was classed as crop land. Ninety percent of the farm operators were owners of all or part of the land they operated in 1945. Farm incomes average \$7,563 in 1944 as compared with \$2,332 in 1939, an increase of 208 percent. Fifty-six percent of the operators had gross farm incomes of over \$4,000 in 1944.

Statistical information received from the County Agricultural Agent of Toole County, tabulating 95 percent of the 512 farms in the County, gives a good picture of agricultural activity. Of the 480 farms included in these statistics we observe the following:

Acres seeded in 1946

Wheat	95,000
Mustard	25,000
Barley	11,000
Oats	6,000

Number of Head 1946

Beef Cattle	12,000
Sheep	24,600

It should be mentioned that the number of sheep is a sharp decline from 60,000 head in 1944 and is typical of the trend in western Montana.

In Glacier County, crops for the most part are produced only in the eastern section of the County. The western one-third of the County



is in the Glacier National Park; the central part of the County is in the Blackfeet Indian Reservation. Farms (ranches in the main) average over 2,500 acres in size and are not evenly distributed over the area. In 1944, approximately 94,000 acres were in harvested crops. Farm incomes averaged \$6,578 in 1944 as compared with \$2,800 in 1939. Thirty-seven percent of the operators had gross farm incomes of over \$4,000 in 1944. Statistical information on Glacier County obtained from the Agricultural Adjustment Agency covering 201 reporting farms, most of which are located in the eastern part of the County but not including the Reservation, reveals:

		<u>Acres seeded in 1946</u>
Wheat		42,000
Barley		24,000
Mustard		15,000
Oats		3,000
		<u>Number of Head 1946</u>
Beef Cattle		8,261
Sheep		19,822

Records of farming activities on the Blackfeet Indian Reservation (in Glacier County) with headquarters at Browning, Montana, are quite complete. Four hundred twenty-seven Indian families on the reservation obtain income from agriculture, varying from income from one cow to income of the largest Indian rancher with 500 head of fine Hereford cattle. Records in the office of the Agricultural Extension Agent at the reservation indicate:

		<u>Acres seeded in 1946</u>
Wheat		2,603
Oats		1,774
Barley		1,294
Mustard		835



	Number of Cattle	
	1946	1945
Beef Cattle	17,158	12,649
Sheep	25,318	33,000
Horses	*2,069	5,786
*Exclusive of Range Horses		

Present plans of the Extension Service call for a further decrease in sheep population to approximately 18,000 and future increase in number of beef cattle to approximately 50,000 head. In addition to the livestock owned by Indians living on the Reservation, 30,565 head of sheep were shipped this year to the Reservation from Oregon and Washington for summer grazing on leased land.

A comparison by groups of gross farm incomes in 1944 is shown below for Glacier and Toole Counties. 1/ Data for Liberty County shows similar characteristics as for Glacier and Toole Counties.

<u>Gross Farm Income in 1944</u>	<u>Percent of Farmers in Each Income Group</u>	
	<u>Glacier</u>	<u>Toole</u>
Under \$250	12.7	6.1
\$250 - \$399	3.3	.9
\$400 - \$599	5.7	1.4
\$600 - \$999	9.6	3.6
\$1,000 - \$1,499	8.4	4.8
\$1,500 - \$2,499	12.3	12.4
\$2,500 - \$3,999	10.5	14.7
\$4,000 - \$5,999	13.1	14.5
\$6,000 - \$9,999	10.1	18.6
\$10,000 - \$19,999	9.6	16.3
Over \$20,000	4.7	6.7

Recreation. During the summer of 1946 (to August 15) 154,000 visitors and tourists entered Glacier National Park. All tourists entering or leaving the east entrance of the park travel through this area, bringing trade to Browning, Cut Bank, and Shelby. Tourists to and from Canada through the two ports of entry at Sweet Grass and Babb patronize hotels, cabin camps, and restaurants in the towns served by the cooperatives.

1/ U. S. Census, Agriculture, 1945



Resort hotels and cabin camps in and near Glacier Park offer recreational facilities for the fisherman and sightseers desiring true natural beauty and primitive native scenery. Little development of individually owned seasonal cottages has taken place in the past and little future development of this kind is foreseen at the present time. However, several new cabin camps and resort hotels are planned to be constructed during the next five years.

In summary, the economy of the area during the next ten years will continue to be based on development and production of oil and gas, agriculture, primarily grains, beef cattle and sheep, as well as on increased recreational development. The survey indicates a very bright future for the cooperatives, provided the cooperatives pursue an aggressive power use program taking full advantage of all opportunities.



## SOURCES OF SUPPLY

The source of all central station electric service in the area is the generating plant at Shelby recently acquired by the Marias River Electric Cooperative, Inc., from the Great Northern Utilities. Glacier County Electric Cooperative, Inc., serving Glacier County, purchases energy from the Marias River Electric Cooperative, Inc., at a cost of Approximately 8 mills per KWH.

The generating plant of the Marias River Electric Cooperative, Inc., consists of the following equipment:

- 2 - 1000 KW Turbines
- 1 - 550 KW Natural Gas Unit
- 1 - 165 KW Natural Gas Unit
- 1 - 200 KW Steam Unit

Although the rated capacity of the plant is 2915 KW, various plant conditions limit the output to approximately 2800 KW. The firm capacity of the plant is approximately 1800 KW. The present equipment has not been out of service for over a year.

This study discloses that the maximum demand during the winter (peak season) of 1946 will probably exceed the capacity of this plant. Furthermore, should part of the equipment be removed from service during the peak season, adequate service could not be rendered to a load likely greater than the present one.

Electricity is generated at this plant at a cost of from 7.5 to 8 mills. Equipment added to the present generating plant would materially increase the output and would decrease the cost of generation. However, at the present time, it appears that during the next two or three years the capacity of the plant may not be increased because of the scarcity of suitable equipment.



Power sources in adjacent areas are:

1. Montana Power Company 55 KV Transmission line at Conrad, Montana, located approximately 26 miles south of Shelby. Montana Power Company has quoted the cooperative (Mont. 31 Toole) rates as follows:

Demand, \$1.00 per KW per month  
75 KW Minimum Demand

First	50,000 KWH/mo. @	8 mills per KWH
Next	150,000 KWH/mo. @	6 mills per KWH
Next	300,000 KWH/mo. @	5 mills per KWH
Over	500,000 KWH/mo. @	4 mills per KWH

The estimated average cost of additional energy, if purchased from Montana Power Company is approximately 9 mills per KWH.

2. At Havre, Montana, located approximately 105 miles east of Shelby, Bureau of Reclamation 154 KV line from Fort Peck to Great Falls, Montana, via Havre. The Bureau is understood to be considering construction of a high voltage transmission line from Havre to Shelby. At this time it is estimated however that should such line be constructed, it will not be completed in less than 3 to 5 years.



### OTHER UTILITIES

Except for the operating area of these two cooperatives, the Montana Power Company's integrated network of high voltage transmission lines throughout the western part of the state is serving practically all principal towns and cities. The Montana Power Company's grid system approaches Shelby on the south with a 55 KV transmission line at Conrad, 26 miles away, and on the east with a 55 KV transmission line at Chester, approximately 45 miles from Shelby.

The Hill County Electric Cooperative, Inc., (REA cooperative Montana 32 Hill) with headquarters at Havre, Montana, have plans for serving the eastern part of Liberty County. Sun River Electric Cooperative, Inc., (REA cooperative Montana 2 Cascade) with offices at Fairfield, Montana, serves the rural area to the south of Glacier and Toole Counties. The county boundary lines form the southern operating border for these two cooperatives (Montana 30 and 31).

None of the area now served, or proposed to be served, by these two latter cooperatives in Toole, Glacier and Liberty Counties is at the present time served by any utility.



## TYPES OF LOADS TO BE SERVED

The loads which are served now, or which may be served in the future by the cooperatives are discussed in the following pages. As materials become available and feasibility is established, the cooperatives contemplate extensive construction programs to serve the remaining number of unserved farms and other loads.

Present cooperative loads in the area are comprised of town loads, industrial loads, and a few farms. It should be mentioned that materials have been ordered for construction of 680 miles of rural distribution lines and construction of these lines will start as soon as possible.

In estimating the extent of future increase of consumption of electric energy on the cooperatives' systems, the estimates have been divided into two sections as follows:

- (1) Existing Systems as of 1946, and
- (2) Future Additions to Existing Systems (New Construction).

### Existing Systems as of 1946.

Since practically no new construction has been undertaken by the Great Northern Utilities during the past ten years, except for rehabilitation and short service extensions within towns already served and since complete records reflecting natural growth of this recently acquired utility had been kept during its years of operation, it is felt that these operating records present a fair basis for projecting future increases in load on the respective parts of the existing system acquired from Great Northern Utilities by each cooperative.

Table No. 1 indicates the yearly demand (KW) on the generating plant during the years 1936 to 1945 inclusive, together with the output (KWH) generated each year and the yearly increase of each, together with the corresponding annual load factors.



Table No. 2 indicates the KW demand and KWH consumption on each of the transmission lines served by the Shelby generating plant from 1938 to 1946.

Table No. 3 shows the increase in the number of meters on the systems from 1930 to 1946. (August 1946 reports from the cooperatives show a total of 2,742 members).

Table No. 4 indicates the system energy losses of the combined systems from 1940 to 1945.

Table No. 5 indicates for each of the systems the number of meters and their location in June 1945 and June 1946.

Table No. 6 reflects the percentage of total demand on the plant required to serve line #3 (Glacier County Electric Cooperative, Inc.).

Table No. 7 lists the substations of each cooperative, their capacity and peak demands during the years 1942 to 1945, inclusive.

Operating records disclose that the peak KW demands on the generating plant during the past years have occurred during the last quarter of each calendar year, generally in November and December. Peak KW demand in 1945 exceeded the peak KW demand of 1944 by 19.38%. During 1946 monthly peak demands have exceeded the KW monthly peak demands of 1945 as follows:

	<u>1945</u>	<u>1946</u>	<u>% of increase</u>
January	1800 KW	2260 KW	25.5
February	1700 KW	2060 KW	21.0
March	1680 KW	2000 KW	19.0
April	1600 KW	1980 KW	23.75
May	1560 KW	2000 KW	28.0
June	1510 KW	1780 KW	17.0
July	1580 KW	1900 KW	20.0

From the foregoing it is reasonable to assume that the 1946 KW peak demand (November and December) will exceed the 1945 peak by 25% or more, reflecting a KW peak demand on the generating plant of at least 2,925 KW and



exceeding the plant's installed generating capacity by 125 KW. In Table No. 10 this has been estimated conservatively as 2,900 KW.

From Table No. 6 it will be noted that Line #3 serving Glacier County through Glacier County Electric Cooperative, Inc., accounts for approximately 45% of the total demand on the generating plant, leaving 55% of the total demand to be utilized by the Marias River Electric Cooperative, Inc. On this basis the 1946 peak demand of each system has been estimated in Tables 8 and 9 as 1,300 KW (45% of 2,900 KW) and 1,600 KW (55% of 2,900 KW), respectively. Assuming a uniform load factor of 47% on the two cooperatives as reflected in Table No. 1 (47% approximates 10 year average), we arrive at a basis on which total KWH requirements for 1946 for each cooperative may be computed as indicated in Tables 8 and 9.

Past experience as indicated in Table No. 1 reflects an average KWH increase of approximately 9.19 percent per year including the years of 1943 and 1944 when many business establishments, because of wartime restrictions were closed and others such as filling stations observed early closing hours. During the same period, the average increase in KW peak demand was approximately 7.4 percent. During 1946 (to date) in the town of Cut Bank alone, permits have been issued for the construction of 42 new homes and business establishments valued at \$226,000.00. Similar building activity is noted in Shelby and other towns now served by the cooperatives. When building restrictions are removed and building materials become available, it is estimated that at least 75 new homes will be constructed in Cut Bank alone, an equal number in Shelby, and similar accelerated activity will be noted throughout the entire area now being served. Likewise, accumulated demands for electrical appliances will be met during 1947, 1948, 1949, and 1950. On this basis it is



estimated that the yearly KW demand on individual systems will increase as follows:

1947	35%
1948	15%
1949	15%
1950	15%
1951	15%

Assuming that the KW demand increase will be less after 1951, it is estimated that the yearly increases will be 10 percent during each of the years 1952 to 1956, inclusive.

Table No. 1 indicates an average annual load factor of 47.4 percent for the years 1936 to 1945, inclusive. The annual load factor did not fall below this average during the past five years except in the year 1945 when it was 46.9 percent. Therefore, in order to arrive at the estimated annual KWH consumption in the years 1948, 1951 and 1956 for the Existing Systems (1946), a load factor of 50 percent has been applied to the estimated peak demand for those years. Tables 8 and 9 show the estimated KW demands and KWH requirements of each cooperative for the years 1946, 1948, 1951, and 1956.

#### Future Additions to Existing Systems (New Construction)

Rural Extensions: It has not been the policy of the Great Northern Utilities, recently acquired by the cooperatives, to extend distribution lines into the adjacent sparsely settled rural area. Acquisition of this system by the cooperatives makes it possible to construct these rural extensions on an area coverage basis. Rural consumer sign-up reflects an average minimum monthly guarantee of \$9.00 per rural member. Based on present cooperative rates this in turn reflects a consumption of approximately 250 KWH per rural member per month. It is reasonable to assume that these members will purchase appliances as quickly as possible in order to use all the energy for which they have agreed to pay.

For the reasons stated above, it is believed that appliances such as electric ranges and electric hot water heaters will reach a high point of saturation, and on this basis it is estimated in Tables 8 and 9 that the average yearly KWH consumption among rural members will be 3,000 KWH in 1948, 3,600 KWH in 1951 and 5,400 KWH by 1956. Similarly, it is estimated that the average demand per rural consumer at peak load will be 0.9 KW in 1948, 1.0 KW in 1952, and 1.5 KW in 1956. 1/

Oil Well Pumps. Much interest has been demonstrated by oil companies in the pumping of oil wells with electric motors. In the past gas engines have been used with fair success, however, considerable labor is necessary in servicing these engines.

Controlled automatic electric pumping during the off peak hours will not only save labor in the field but will materially increase the systems' load factors, benefiting mutually the oil producers and the cooperatives, providing a rate satisfactory to both the oil producers and the cooperatives can be established.

At present the cooperatives are serving four small producers who are pumping electrically. Several months ago the A. B. Cobb & Company requested the cooperative (then Great Northern Utilities) to furnish information, rates and a plan for pumping 40 oil wells at its Trigood Camp south of Cut Bank. Quite recently the Carter Oil Company requested similar information for pumping 150 wells located north of Cut Bank, some 6 miles south of the Canadian border.

Experience indicates that 5 H.P. motors will be used on each well in Toole County. Based on past experience, it is anticipated that each

1/ Engineering Memorandum No. 33R3, Maximum Demand Curves, dated May 20, 1946. Rural Electrification Administration, U.S.D.A.



motor will consume approximately 10,500 KWH per year. Wells in the Cut Bank field are of a greater depth and experience indicates that 7 H.P. motors will be used having an annual consumption of 25,000 KWH. Records of the Geological Survey indicate that at present there are approximately 1000 producing oil wells in the Cut Bank field in Glacier County and approximately 1400 producing oil wells in the Kevin-Sunburst field in Toole County. It is estimated that 20 percent of the now producing wells will be pumped with electricity in 1948, 35 percent in 1951 and the increase in number of oil wells in the next ten years should reflect that by 1956 there will be in operation at least 850 electrically pumped oil wells in Toole County and 450 electrically pumped oil wells in Glacier County. These estimates are based on the belief that production of oil will taper off over a much longer period than the estimated 6.6 productive years remaining in the Kevin-Sunburst field and the estimated 10 productive years remaining in the Cut Bank field.

Grain Elevators. At present there are 7 unserved grain elevators in Toole County. Investigation discloses that these will have a maximum demand of 10 HP each and an annual consumption of approximately 13,000 KWH each.

Flour Mills. At present a flour mill to be erected at Ethridge is in the planning stage, and it is believed this mill will be in operation by 1948. Information furnished the cooperative (Mont. 31 Toole) indicates that this mill will have an estimated maximum demand of 75 H.P. with an annual consumption of 118,000 KWH.

CAA Fann Station. The proposed route of the Great Northern Airways traverses the area from east to west and it is assumed that a Fann station, or continuous radio directional station, will be erected in eastern Toole or in western Liberty County. This proposed station, according

to cooperative records on the station now served near Cut Bank, would have an approximate system demand of 5 KW and consume approximately 30,000 KWH yearly.

Irrigation. At present there are 7 farms irrigating from the Marias River near Shelby by means of gasoline engine pumping. It is expected that these will convert to electric motors as soon as possible. If sufficient water is available from the Marias River after due allowance for future additional depletion of this stream by construction of the proposed Lower Marias Irrigation Project and Tiber Reservoir, it is believed that at least 10 pump units will be in operation near Shelby in 1948, 20 by 1951 and 25 by 1956. These estimates are included in Table 9. It is estimated that these electric motors will average approximately 20,000 KWH each annually.

Resort Hotels. At present the Glacier Park Hotel (and Glacier Park Station) purchases part of its electric energy from the cooperative, generating the balance at its own plant. Park officials advise that they expect to abandon use of the generating plant before the beginning of the 1947 season and that all of their energy requirements will be purchased from the cooperative. As this consumer now receives service from the existing system the increased load will be reflected in increased demands of the Existing System as indicated in Table No. 8.

Plans to serve Many Glacier Hotel and Two Medicine Hotel, located in the eastern part of Glacier National Park, are now being made and it is believed that service will be extended by the cooperative within the next five years. These hotels will have an estimated individual demand of approximately 40 KW each; however, because of their very short season and based on the cooperative's experience with Glacier Park Hotel, the



annual consumption is estimated to be approximately 21,000 KWH.

The serving of cabin camps at Babb, St. Mary's, and Going-to-The-Sun Chalets is anticipated by 1951. It is estimated that these cabin camps will have an individual maximum demand of approximately 25 KW with an average consumption of 13,140 KWH annually.

## ESTIMATES OF LOADS

Table No. 8 contains the detailed estimates of total maximum kilowatt demands and kilowatt hour consumptions anticipated by Glacier County Electric Cooperative, Inc., (Mont. 30 Glacier) in 1946, 1948, 1951, and 1956. Table No. 9 contains similar information for the Marias River Electric Cooperative, Inc., (Mont. 31 Toole).

The estimates in connection with "Future Additions to the Existing Systems" are broken down into the number of each type of consumer and show the maximum demand of and the factor applied to each in arriving at the proportion of kilowatt demand that each type of load contributes to the system's totals. For example, @40/1.67F refers to a total estimated demand of 40 kilowatts and an overall factor of 1.67, which represents the demand factor of the individual load plus diversity between loads of the same type and overall diversity between loads of different types when connected to the system. In this manner industrial loads have been reduced to a value which may be added arithmetically to the estimated demand of farm, non-farm, and commercial consumers.

System losses are included in the tabulation of estimated consumption on "Existing System" for the reason that the percentage of increase is based on total KWH generated at the plant. System losses have been applied to "Future Additions to Existing Systems" in order to arrive at the total kilowatt hour requirements of the systems and are based on operating experience of rural electric cooperatives operating in Montana.

Table No. 10 reflects the combined power requirements of the two systems and shows the estimated KW demands and KWH requirements for the two interconnected systems in the years 1946, 1948, 1952 and 1956.



Appendix A contains a list of the more important industrial loads presently served by the existing systems and shows the average annual KW demands and KWH requirements for these loads.

TABLE NO. 1

KWH OUTPUT AND KW DEMAND

GENERATING PLANT--SHELBY, MONT.

<u>YEAR</u>	<u>KWH GENERATED</u>	<u>KWH INCREASE OVER PREV. YR.</u>	<u>PERCENT OF KWH INCREASE</u>	<u>KW MAX. PEAK DEMAND</u>	<u>PERCENT OF KWH INCREASE</u>	<u>ANNUAL LOAD FACTOR</u>
1935	4,118,135					
1936	5,164,010	1,045,875	25.39	1280		46.0 %
1937	5,397,090	232,080	4.49	1360	6.25	45.1 %
1938	5,506,994	109,904	2.03	1480	8.82	42.6 %
1939	6,316,905	809,011	14.70	1620	9.45	44.5 %
1940	7,470,720	1,153,815	18.26	1900	17.28	44.8 %
1941	8,129,820	650,100	8.82	2000	5.26	47.0 %
1942	8,790,945	661,125	8.13	2100	5.0	47.6 %
1943	8,946,940	155,995	1.77	1760	(16.19)	57.8 %
1944	9,093,500	146,560	1.63	1960	11.36	52.8 %
1945	9,701,900	608,400	6.69	2340	19.38	46.9 %

NOTE: ( ) denotes decrease.



TABLE NO. 2

KW DEMAND AND KWH CONSUMPTION  
ON

TRANSMISSION LINES ORIGINATING AT SHELBY GENERATING PLANT

YEAR	LINE #1		LINE #2		LINE # 3		Shelby Line	
	Dem.	Cons.	Dem.	Cons.	Dem.	Cons.	Dem.	Cons.
1938	280	1,192,400	89	319,160	660	2,588,100	334	998,960
1939	600	1,301,800	148	329,280	710	3,112,500	372	1,100,980
1940	340	1,451,500	204	382,700	900	3,829,000	386	1,269,160
1941	320	1,331,700	186	417,560	950	4,298,100	438	1,323,940
1942	370	1,574,000	193	513,520	1000	4,679,100	427	1,273,560
1943	342	1,495,200	174	527,320	900	4,812,000	371	1,296,960
1944	390	1,813,400	178	511,440	900	4,666,700	401	1,378,980
1945	440	1,747,200	167	441,600	1060	5,106,300	490	1,509,780
1946*	380	931,300	228	263,200	1020	3,241,200	424	975,420

\* 1st seven months only.

Above figures do not include KW Demand and  
KWH Consumption for station use in Generating Plant.

Line #1 - North Serving Oilmont, Kevin Sunburst & Sweetgrass.

Line #2 - South Serving City Pump, and Gravel Pit.

Line #3 - West Serving Cut Bank, Blackfoot, Growing and Glacier Park.  
(Montana 30 Glacier).

Shelby Line - Serves town of Shelby.

TABLE NO. 3

TOTAL NUMBER OF METERS ON SYSTEMS

<u>DATE</u>	<u>NUMBER OF METERS</u>
Jan. 1, 1930	1551
Jan. 1, 1935	1935
Jan. 1, 1940	2979
Jan. 1, 1945	3027
Jan. 1, 1946	3184

NOTE: The above figures do not accurately indicate the number of consumers as some consumers have more than one meter because of rate structure.

\* \* \*

TABLE NO. 4

SYSTEM LOSSES ON THE COMBINED SYSTEMS

<u>YEAR</u>	<u>PERCENT</u>
1940	20.23
1941	20.57
1942	18.24
1943	18.36
1944	17.77
1945	16.50

\* \* \*



TABLE NO. 5

NUMBER OF METERS ON SYSTEMS

CLASSIFIED BY LOCATION

<u>Montana 30 Glacier</u> Line #3	No. of Meters 6-28-46	No. of Meters 6-30-45
Cut Bank & Santa Rita	1155	1120
Browning	442	442
Blackfoot	19	18
Glacier Park	<u>112</u>	<u>83</u>
TOTAL	1,728	1,663

<u>Montana 31 Toole</u> Line #1		
Kevin	125	142
Oil Field (Kevin)	78	75
Oilmont	43	40
Sunburst	203	190
Sweetgrass	93	93
Shelby & Line #2	<u>992</u>	<u>1,000</u>
TOTAL	1,534	1,540

TABLE NO. 6

LINE #3 DEMAND

AND PERCENT OF TOTAL DEMAND ON GENERATING PLANT

<u>YEAR</u>	<u>TOTAL KW SYSTEM DEMAND</u>	<u>KW DEMAND LINE #3</u>	<u>LINE #3 % OF TOTAL DEMAND</u>
1940	1,900	900	47
1941	2,000	950	47
1942	2,100	1,000	47
1943	1,760	900	51
1944	1,960	900	45
1945	2,340	1,060	45



TABLE NO. 7

SUBSTATIONS AND DEMANDS

Glacier County Electric Cooperative, Inc.	KVA Capacity	PEAK KW DEMAND				August 1946
		1942	1943	1944	1945	
Cut Bank	600	435	505	580	600	600
Blackfoot	625	325	350	385	400	
Browning	375	225	260	290	300	

Marias River Electric  
Cooperative, Inc.

#2 Near Oilmont	225	150	175	200	190	
#4 at Sweetgrass Serving Sunburst & Sweetgrass	150	125	150	150	135	
Refinery Bank	225		170	170	162	

Transmission Line Substations  
at generating plant

Line #1 (South)	225 KVA
Line #2 (North)	1,000 KVA
Line #3 (West)	1,000 KVA

ESTIMATE OF LOADS  
TABLE NO. 8  
GLACIER COUNTY ELECTRIC COOPERATIVE, INC.  
(MONTANA 30 GLACIER)

TYPES OF LOADS	NO. OF CONSUMERS				KILOWATT DEMAND				ANNUAL KILOWATT HOUR CONSUMPTION			
	1948	1951	1956	1946	1948	1951	1956	1946	1948	1951	1956	
A. Existing System as of 1946 All Types				1,300	2,020	2,995	4,825	5,352,400*	8,847,000*	13,119,000*	21,133,000*	
B. Future Additions to Existing System: Farm, Non-Farm & Commercial Loads	250	375	450		0.9 225	1.0 375	1.5 675		3,000 750,000	3,600 1,350,000	5,400 2,430,000	
Oil Well Pumps (Cut Bank)	200	350	450		7/1.43F 980	7/1.43F 1,710	7/1.43F 2,200		25,000 5,000,000	25,000 8,750,000	25,000 11,250,000	
Resort Hotels		2	2		40/1.67F 48	40/1.67F 48	40/1.67F 48		21,000 42,000	21,000 42,000	21,000 42,000	
Cabin Camps		4	4		25/1.67F 60	25/1.67F 60	25/1.67F 60		13,140 53,000	13,140 53,000	13,140 53,000	
TOTALS				1,300	3,225	5,188	7,810	5,352,400	14,597,000	23,314,000	34,908,000	
System Losses on Future Additions @ 20%									1,450,000	2,545,000	3,425,000	
Grand Total				1,300	3,225	5,188	7,810	5,352,400	16,047,000	25,859,000	38,333,000	

\* Includes Losses



ESTIMATE OF LOADS  
TABLE NO. 9  
MARIAS RIVER ELECTRIC COOPERATIVE, INC.  
(MONTANA 31 TOOLE)

TYPES OF LOADS	NO. OF CONSUMERS			KILOWATT DEMAND			ANNUAL KILOWATT HOUR CONSUMPTION				
	1948	1951	1956	1946	1948	1951	1956	1946	1948	1951	1956
A. Existing System as of 1946 All Types				1,600	2,485	3,680	5,925	6,587,000*	10,884,000*	16,118,000*	25,951,000*
B. Future Additions to Existing System: Farm, Non-Farm & Commercial loads.	400	500	600		@ 0.9 360	@ 1.0 500	@ 1.5 900		@ 3,000 1,200,000	@ 3,600 1,800,000	@ 5,400 3,240,000
Oil Well Pumps (Kevin-Sunburst)	280	490	850		@ 5/1.43F 980	@ 5/1.43F 1,715	@ 5/2.0F 2,125		@ 10,500 2,940,000	@ 10,500 5,145,000	@ 10,500 8,925,000
Grain Elevators	7	7	7		@ 10/2.F 35	@ 10/2.F 35	@ 10/2.F 35		@ 13,000 91,000	@ 13,000 91,000	@ 13,000 91,000
Flour Mills		1	1			@ 75/2.5 30	@ 75/2.5 30		118,000	118,000	118,000
Fann Station	1	1	1		5	5	5		30,000	30,000	30,000
Irrigation Pumps.	10	20	25		@ 25/2.F 125	@ 25/2.F 250	@ 25/2.F 312		@ 20,000 200,000	@ 20,000 400,000	@ 20,000 500,000
TOTALS				1,600	3,990	6,215	9,332	6,587,000	15,463,000	23,702,000	38,855,000
System losses on Future Additions @ 20%									1,151,000	1,896,000	3,226,000
GRAND TOTAL				1,600	3,990	6,215	9,332	6,587,000	16,614,000	25,598,000	42,081,000

\* Includes losses

# ESTIMATE OF LOADS SUMMARY

TABLE NO. 10

MONTANA 30 GLACIER & MONTANA 31 TOOLE

	KILOWATT DEMAND				ANNUAL KILOWATT HOUR CONSUMPTION				ESTIMATED LOAD FACTOR			
	1946	1948	1951	1956	1946	1948	1951	1956	1946	1948	1951	1956
Montana 30 Glacier	1,300	3,225	5,188	7,810	5,352,000	16,047,000	25,859,000	38,333,000	47%	56.9%	56.8%	56.0%
Montana 31 Toole	1,600	3,990	6,215	9,332	6,587,000	16,614,000	25,598,000	42,081,000	47%	54.7%	54.1%	53.9%
	2,900	7,215	11,403	17,142	11,939,400	32,661,000	51,457,000	80,414,000	47%	51.7%	51.4%	53.5%



APPENDIX A

PARTIAL LIST  
OF  
INDUSTRIAL CONSUMERS SERVED

<u>TOOLE COUNTY</u>	<u>Average Annual KWH Consumption</u>	<u>KW Peak Demand</u>
Big West Oil Co. (Refinery) Kevin, Montana	180,000	45
Farmers' Union Grain Terminal Shelby, Montana	53,000	60
The Texas Company (Refinery) Sunburst, Montana	675,000	170
<u>GLACIER COUNTY</u>		
CAA Range Fann Station Cut Bank, Montana	30,000	10
U. S. Gov't Indian Agency, Browning, Montana	520,000	90
Cut Bank Air Field	80,000	60
Museum, (Indian) Browning, Montana	5,000	4
Union Oil Co. (Refinery) Cut Bank, Montana	550,000	126
Carter Oil Co. (Refinery) Cut Bank, Montana	480,000	81







